

WHAT IS CLAIMED IS:

1. A turbine blade comprising:

an airfoil having a root end and a tip end;

at least one cooling passageway in said airfoil, said at least one cooling passageway extending from the root end to the tip end and having a circular cross-section;

a plurality of turbulation promotion devices in said at least one cooling passageway; and

each of said turbulation promotion devices being arcuate in shape and circumscribing an arc less than 180 degrees.

2. A turbine blade according to claim 1, wherein said plurality of turbulation promotion devices includes a pair of aligned turbulation promotion devices, and end portions of a first one of said pair of aligned turbulation promotion devices being spaced apart from end portions of a second one of said pair of aligned turbulation promotion devices.

3. A turbine blade according to claim 1, wherein said plurality of turbulation promotion devices includes at least two aligned turbulation promotion devices, and end portions of

one of said aligned promotion devices is spaced apart from end portions of another of said aligned promotion devices.

4. A turbine blade according to claim 2, wherein said end portions are spaced by a gap in the range of from $1e$ to $4e$ where e is the height of a turbulation promotion device.

5. A turbine blade according to claim 2, wherein each said passageway has a diameter D and each turbulation promotion device has a height e , and wherein the ratio of e/D is in the range of from 0.05 to 0.30.

6. A turbine blade according to claim 1, wherein said turbulation promotion devices comprises arcuately shaped trip strips.

7. A turbine blade according to claim 1, wherein said plurality of turbulation promotion devices comprises a plurality of turbulation promotion devices aligned along an axis which extends from said root end to said tip end.

8. A turbine blade according to claim 7, wherein said plurality of turbulation promotion devices are separated by a pitch P , each of said turbulation promotion devices has a height e , and a ratio of P/e is in the range of 5 to 30.

9. A turbine blade according to claim 7, wherein said aligned turbulation promotion devices comprise pairs of aligned turbulators with each pair of turbulators having spaced apart end portions.

10. A turbine blade according to claim 9, wherein said spaced apart end portions of a first pair of turbulators is axially aligned with spaced apart end portions of adjacent pairs of turbulators.

11. A turbine blade according to claim 1, wherein said turbulation promotion devices comprises a plurality of notches cut into a wall of said at least one cooling passageway.

12. A turbine blade according to claim 1, wherein said turbulation promotion devices comprise a first set of turbulators and a second set of turbulators offset from said first set of turbulators.

13. A turbine blade according to claim 1, wherein each of said turbulation promotion devices has a surface which is normal to an axis extending from said tip end to said root end.

14. A turbine blade according to claim 1, wherein each of said turbulation promotion devices has a surface which is at an angle in the range of from 30 degrees to 70 degrees with

respect to an axis extending from said tip end to said root end.

15. A turbine blade according to claim 13, wherein said turbulation promotion devices comprise a first set of turbulators and a second set of turbulators offset from said first set of turbulators.

16. A turbine blade according to claim 1, further comprising a plurality of cooling passageways extending from said root end to said tip end and each of said cooling passageways having a plurality of said turbulation promotion devices.

17. A turbine blade according to claim 16, wherein said plurality of turbulation promotion devices in each of said cooling passageways has a surface which is normal to a flow of cooling fluid through said cooling passageways.

18. A turbine blade according to claim 16, wherein said plurality of turbulation promotion devices in each of said cooling passageways has a surface which is at an angle in the range of from 30 degrees to 70 degrees with respect to a flow of cooling fluid through said cooling passageways.

19. A turbine blade according to claim 16, wherein said plurality of turbulation promotion devices in each of said

cooling passageways includes a first set of turbulation promotion devices which is offset from a second set of turbulation promotion devices.